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ABSTRACT

The Remedial Mathematics Skills Program funded under Elementary and Secondary Education Act Title I serviced students who were two or more years below grade level in mathematics in 50 New York City high schools for the 1974-1975 school year. The program objective was to improve students' computational skills through the use of calculators, computer assisted drill work, drill kits, project oriented activities, and other appropriate materials in a supplementary, individualized, corrective mathematics program. Approximately 7300 students from grades 9 through 11 participated in the program. Statistically significant gains were achieved by students as measured by the Metropolitan Achievement Test (Advanced Level). The teaching of computational skills to high school students in small classses with individualized instructions (and the use of calculators) is apparently effective in significantly improving mathematics skills. (Author/AM)

EVALUATION REPORT

Function No. 09-59616

REMEDIAL MATHEMATICS SKILLS PROGRAM

SCHOOL YEAR 1974-1975

Prepared by

Alfred S. Posamentier, Ph.D.

An evaluation of a New York City School district educational project funded under Title I of the Elementary and Secondary Education Act of 1965 (PL 89-10) performed for the Board of Education of the City of New York for the 1974-75 school year.

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CHAPTER I

THE PROGRAM

The Remedial Mathematics Skills Program was designed to help high school students (from grades 9,10, and 11) from economically deprived areas, who were two or more years below grade level in mathematics, to improve their computational skills. Fifty New York City high schools participated in the program.

Students were selected for the program in a number of ways. Teachers, guidance counselors, grade advisors, and department chairmen recommended students whom they felt were sufficiently retarded in mathematics to warrant entrance into the program. In addition many schools engaged in school-wide advertising campaigns to publicize the merits of the program and attract students, who qualified for admission to the program, but were overlooked in the previously described recommendation system.

After students had been recommended (or volunteered) for the program, the Metropolitan Achievement Test (pre-test) was administered. Students who were not below grade level in mathematics by two years or more were released from the program. This selection procedure was completed within the first two weeks of each semester.

As a result of participation in the program, the mathematics grade levels of students were supposed to show a statistically significant difference of the real post-test score and the anticipated post-test score on the Metropolitan Achievement Test.

In order to bring about this improved mathematics grade, students were placed in classes ranging in size from 10 to 17 students. These classes, (meeting one period per day, five days per week), were directed by a teacher with the aid of an educational assistant. This class was offered in addition to the students' regular mathematics class. Most of the student activities centered on drill activities. In order to generate interest in these activities and in mathematics in general, students were provided with electronic calculators to check their work and manual calculators to observe the processes involved in the various computational algorithms. The Compucorp machines provided computer assisted practice of various computational skills. To further motivate students toward mathematics a variety of materials and mathematical games were used. A good portion of the materials used was prepared by the teacher trainers and the classroom teachers.

A rather close monitoring of the program was carried out by the staff of ten teacher trainers, each of whom made regular visits to from six to nine schools. These visits provided opportunities for training teachers to work more successfully in the program. Dissemination of curriculum materials and ideas also resulted from these visits.

This program was operative for the entire school year 1974-1975.

CHAPTER II

EVALUATIVE PROCEDURES

The evaluation objectives for the program were:

1. To determine whether, as a result of participation in The Remedial Mathematics Skill Program, the mathematics grade of the students would show a statistically significant difference between the real post-test score and the anticipated post-test score.
2. To determine the extent to which the program, as actually carried out, coincided with the program as described in the Project Proposal.

In order to analyze the first objective, the Metropolitan Achievement Test (Advanced Level) was administered to all students in the program when they entered (pre-test) and exited (post-test) the program. The pre-test was administered during the first week of each semester (in September, Form F, and in February, Form G) except for late entrants, to whom this test was administered upon entrance to the program. For the most part, testing was completed during the first two weeks of each semester. Students, who left the program in January 1975, took the post-test (Form F) during the second week of January, while the remainder of the students (some of whom entered in February and others who entered in September) took the post-test (Form H) during the second week of May, 1975. Data was collected from the 50 high schools during the week following the administration of each test. After data was collected and organized a Historical Regression Analysis was performed.

It should be noted that because of persistent truancy problems, transient populations, and other similar factors, at many participating high schools, the number of students in the program (12,070) was less than the number of students (13,725) projected for the program. In addition, some participating

high schools had difficulty obtaining students for the program since the Remedial Mathematics Skills Program was competing for students with other special programs (e.g. reading). This was particularly true in some of the participating vocational high schools, where students were programmed for a full day of instruction and had difficulty finding time on their program for even one additional class. This was however counteracted by the fact that the number of students serviced by the program reflects those students who were serviced by the program for only one semester. Hence, one student position in the program might have been used to actually service two students. Since the schools in the program found a greater need to service ninth grade students than tenth or eleventh grade students, the actual number of ninth grade students (7,540) was greater than the projected number (4,057). This actual number of ninth grade students also reflects the many students only serviced for one semester. Since the number of ninth grade students was greater than anticipated, the number of tenth and eleventh grade students actually serviced (4,530) was less than the anticipated number (9,668).

The basic reason for not including all students serviced in the analysis of data was the problem of truancy. The analysis of data included 60.71% of the students serviced.

CHAPTER III

FINDINGS

Data Analysis

In order to determine whether, as a result of participation in the Remedial Mathematics Skills Program, the mathematics grade of students showed a statistically significant difference between the real post-test score on the Metropolitan Achievement Test (Advanced Level) Form G (January) or Form H (May) and the anticipated post-test score, based on a pre-test of the Metropolitan Achievement Test (Advanced Level) Form F (September) or Form G (February), a Historical Regression Analysis was used. The mean pre-test score for the 4,117 ninth grade students was 6.13 (with a standard deviation of 3.64), for which a mean predicted post-test score of 6.31 (with a standard deviation of 2.29) was computed. The mean post-test score for this group was 7.21 (with a standard deviation of 1.09) which differed significantly from the predicted post-test score at the .001 level of confidence ($t = 25.25$).

The mean pre-test score for the 3,211 students in the tenth and eleventh grade was 6.19 (with a standard deviation of 1.59), for which a mean predicted post-test score of 6.48 (with a standard deviation of 1.46) was computed. The mean post-test score for this group was 7.43 (with a standard deviation of 1.51), which differed significantly from the predicted post-test score at the .001 level of confidence ($t = 42.33$).

MEANS AND STANDARD DEVIATIONS OF MATHEMATICS COMPUTATION SCORES ON THE METROPOLITAN ACHIEVEMENT TEST

Group	Pretest			Predicted Posttest			Posttest			t-value
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	
9th grade	4117	6.13	3.64	4117	6.31	2.29	4117	7.21	1.09	25.25 *
10th and 11th grade	3211	6.19	1.59	3211	6.48	1.46	3211	7.43	1.51	42.33 *

Other Findings

The on-site visits by the evaluator generated the following findings:

1. In schools where the number of teachers in the program merited a teacher coordinator, it was found that there was a great diversity in the operation and function of these coordinators. In some schools they prepared curriculum materials, while in other schools they merely offered assistance to individual teachers.

2. In most schools the primary activity was teachers tutoring individual students. No small or large group instruction was observed.

3. While the pre-test results on the Metropolitan Achievement Test were widely used for diagnostic purposes, there was no uniformity in this usage. Some schools wrote their own diagnostic tests.

4. In a number of schools calculators were not in use. In other schools the calculators were being used and, had they been available, many more could have been used. Manual calculators were very rarely used.

5. The program was effectively directed by the program head, who was in constant contact with teachers, coordinators, department chairmen and teacher trainers. Feedback from these sources was encouraged.

6. The educational assistants were an integral part of the program. The good rapport they had with teachers and students in the program made them a valuable asset to the program.

Facilities and Materials

In most of the participating high schools, the facilities were quite good. In some high schools the classroom teachers did a fine job decorating their classrooms. This was certainly in the spirit of motivating the students toward mathematics. Even in classrooms which were not designed for individual instruction (those with stationary seats and desks), teachers for the most part improvised properly to bring about a comfortable individualized learning setting.

The main problem with a small number of rooms used in the program, was inadequate electrical facilities. The optimum setting provided electrical outlets in all parts of the room so that the electronic calculators and computers could be used when and where needed. Unfortunately this was not the case in all rooms used for the program.

Some schools which were very crowded had to schedule the program's classes in the cafeteria, or had to schedule two classes to one large room during the same period. Although this was not desirable, teachers involved worked rather well in these situations. Fortunately this only happened in a relatively small number of cases.

A third problem involving facilities for the program occurred in the storage of the calculators and computers. Since these machines had to be stored in a safe place, some schools stored them in places remote from the classrooms in which they were used. This presented a problem to teachers having to transport the machines. At times the machines were not used because of severe transportation problems. It should be noted that this problem was rather isolated in the program.

The materials used in this program were quite appropriate for the population served. The only item which merits some reassessment is the manual calculator (Nippon). The intended use of this machine was as an aid in understanding computational algorithms as well as checking students' computational drill problems. As an aid to checking computational exercises, the machine lost popularity among the students in light of the more attractive and more efficient electronic calculator. As an aid to teaching the computational algorithms, the machines proved too complicated for students to follow and too cumbersome to use (compared to the electronic machines). Only

in a few schools, especially the participating vocational high schools (for male students) where the students are generally more mechanically inclined, were these machines somewhat more appreciated and thereby more motivational.

All aspects of the program proposal were fully implemented in the actual program, with the exception of the video-taping pilot project whose implementation began in April 1975. The late start was due to delayed delivery of equipment.

By the very nature of the selection procedure the program has serviced the needs of the specific target population. That is, all students came from economically deprived areas and were two or more years below grade level in mathematics.

Recommendations From Last Prior Study

1. It was recommended that a special room be assigned to the program in each school. This room should contain the needed electrical outlets, movable chairs and desks, and adequate storage space with proper security for equipment.

This recommendation was considered and where possible implemented. However in some schools the problem of improper facilities still exists and is apparently still being considered.

2. Teachers and educational assistants should be given more frequent training sessions before the program begins and during its operation.

This recommendation has been implemented as much as possible with the existing staff.

3. The teacher trainers should be more thoroughly prepared for their responsibilities and their role should be made more clear to the chairmen and staff.

As best as can be evaluated this recommendation has been incorporated into the program.

4. Assign teacher trainers a limited number of schools so that they can spend at least a half day every week in each school. Their visits should be scheduled so that the chairmen and teachers may be more readily available for workshops and meetings.

This recommendation has been considered but still needs to be restated in this report. Some teacher trainers must still make more of an effort to schedule meetings where the entire staff of the program at a particular school can meet in a workshop session.

5. When possible, teachers should have common prep periods so that there may be more opportunity for either scheduled meetings with the teacher trainers, teacher coordinators, or chairmen or more informal sharing of ideas and practices among the teachers themselves.

This recommendation has been achieved by a few schools, but because of overcrowded schools and general programming problems, this recommendation has not been universally satisfied.

6. Because of the need for more teacher training and more coordination of the program, there should be a school coordinator for each school where there are 3 to 7 teachers in the program. This coordinator will teach 4 remedial math periods to use the 5th period for the purpose of assisting the chairman in implementing the program.

This recommendation has been implemented. In school with 4 to 7 teachers in the program one teacher is relieved of one teaching period to assist in the implementation of the program.

7. Allocate teaching positions to each school and teaching periods with each school to coincide with the number of eligible students or number who actually attend.

This recommendation has been followed, however it is one which continues to merit consideration due to continuous changes in student enrollment.

8. Clarify the role of the educational assistant, and provide more training.

This recommendation has been implemented, but continues to merit consideration in light of personnel changes.

9. Prepare and make available to teachers a guide with a diagnostic test and sample prescriptive program materials, so that those teachers who are new to the program and those who feel a need may refer to it.

This recommendation has been fully implemented.

10. Although much of the materials and activities were effective, they should be made more relevant to the pupil's daily life or vocation.

This recommendation has been implemented with the introduction of teacher-prepared work sheets covering relevant applications of the mathematical skills considered. There is room for more work in the preparation of these materials.

11. Investigate the possibility of using an evaluative instrument which will more clearly measure pupil growth in math computation skills.

Although this may have been investigated, the same evaluative test (The Metropolitan Achievement Test) was still being used. A multiple choice test is not too desirable for these purposes.

12. The nomenclature of the remedial math class should be the same in each school.

Attempts were made to implement this recommendation, but it is beyond the jurisdiction of the program (i.e. it seems to remain a school decision) to make such changes.

13. Assure that there is a more systematic diagnosis of pupils' abilities and planning of remediation on an individualized basis. Progress records should be more conscientiously maintained so that both student and instructor can be aware of and evaluate growth.

This has been fully implemented in the current program.

14. Each month a record of live registers and attendance should be forwarded by each school to the program coordinator.

This was only done once each semester not each month.

The Remedial Mathematics Skills Program is not related to any other special programs in the school.

CHAPTER IV

SUMMARY OF MAJOR FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Major Findings

With the exception of the video-taping component, the program was in full operation throughout the school year. The program was effectively coordinated by the program director, who was in constant contact with teachers, coordinators, teacher trainers and department chairmen. Feedback was encouraged.

For the most part, facilities and equipment used in the program were as described in the proposal.

There was found to be a statistically significant gain of the scores on the Metropolitan Achievement Test over the program period. The program more than met the expectations for this objective.

Conclusion

The teaching of computational skills to high school students in small classes with individualized instructions (and the use of calculators) is apparently effective in significantly improving measured mathematics skills by grade level.

Recommendations and Suggestions for Improving Program

Since the basic objectives of the program were achieved it is recommended that the program be continued for the next school year. The following recommendations are offered for the improvement of the program.

1. As much of the existing program is centered upon drill work, there ought

to be a greater effort made to camouflage this activity so that student interest is kept high. This would entail preparing curriculum materials involving areas of interest to the students.

2. There ought to be a greater emphasis on instruction of concepts, perhaps in small groups, and somewhat less individualized help with drill. When 12-15 students are serviced by one teacher and one educational assistant, there is little time during the period allotted to each student. When more time is devoted to instruction, less time will be available for using the calculators, which might be more desirable. The calculator should remain a novelty item to insure its motivational aspect.

3. The functions of the school coordinators should be clearly defined.

4. Programs of teachers and schedules of teacher trainers should be prepared so as to provide time for meetings of program personnel at each school. A greater joint faculty effort should then follow.

5. The program faculty at each school should have a photocopying machine and a rexograph machine available so that the production of teacher-prepared materials can be encouraged.

6. There is improvement needed in the current system for repairing machines. Inoperative calculators often disrupted program activities.

7. There ought to be a uniform diagnostic instrument prepared by the teacher-trainer staff. This instrument should then be used at all sites. The current use of the Metropolitan Achievement Test for diagnostic purposes is not good, since guessing on multiple-choice items does not provide accurate diagnostic results.

8. The use of the manual calculator in this program should be reevaluated. In the rare instances where it was used, it was rather ineffective and not used as a learning tool as it was intended. The manual calculators were used in the same way as were the electronic calculators (i.e. checking computations). The latter being far more efficient.

9. Since some schools had a greater need for the calculators than other schools, these machines should be allotted to schools on the basis of need. This would indicate that during the semester unused machines at one school would be allocated to schools which can put them to immediate use.

10. Since some schools, forced by overcrowded facilities, had two classes successfully share one large room during the same period, it might prove fruitful to try this on a carefully scheduled basis. When done properly, this sharing provided expanded opportunities for students, since a greater variety of equipment and ideas were available and team teaching was possible.

11. Funds should be available for on-going purchases of educational materials as needed throughout the school year.

EXEMPLARY PROGRAM ABSTRACT

Title:	Remedial Mathematics Skills Program
Component Codes:	60915 60916
Activity Code:	720
Objective Code:	801

Program

The Remedial Mathematics Skills Program serviced students who were two or more years below grade level in mathematics in 50 New York City high schools throughout the entire school year. The program objective was to improve students' computational skills through the use of calculators, computer assisted drill work, drill kits, project oriented activities, and other appropriate materials in a supplementary, individualized, corrective mathematics program.

Summary of Findings

Statistically significant gains were achieved as measured by the Metropolitan Achievement Test (Advanced Level) and the program more than met the expectations for this objective. The analysis of test results obtained for 4,117 ninth grade students revealed a pre-test mean of 6.13 (from which a predicted post-test mean of 6.31 was computed), and an actual post-test mean of 7.21. This gain was significant at the .001 level of confidence. The analysis of test results obtained for 3,211 tenth and eleventh grade students revealed a pre-test mean of 6.19 (from which a predicted post-test mean of 6.48 was computed), and an actual post-test mean of 7.43. This gain was significant at the .001 level of confidence.

Throughout the program a variety of mathematics materials, calculators and computers were used in an individualized setting.

Conclusion

The teaching of computational skills to high school students in small classes with individualized instructions (and the use of calculators) is apparently effective in significantly improving measured mathematics skills by grade level.

Use Table 30A. for Historical Regression Design (6-Step Formula) for Reading (English); Math (English); Reading (Non-English); Math (Non-English).

30A. Standardized Test Results.

In the Table below, enter the requested information about the tests used to evaluate the effectiveness of major project components/activities in achieving desired objectives. This form requires means obtained from scores in the form of grade equivalent units as processed by the 6 step formula (see District Evaluator's Handbook of Selected Evaluation Procedures, p. 45-49). Before completing this table, read all footnotes. Attach additional sheets if necessary.

Component Code	Activity Code	Test Used[1]	Form		Level		Total N[2]	Group I.D.[3]	Number Tested[4]	Pretest		Predicted Posttest Mean	Actual Posttest		Statistical Data	
			Pre	Post	Pre	Post				Date	Mean		Date	Mean	Obtained Value of t	Level[5] of significance
6 0 9 1 5	7 2 0	Mat-70	F&G	G&H	ADV	ADV	7540	Grade 9	4117	9/74 2/75	6.13	6.31	1/75 5/75	7.21	25.25	.001
6 0 9 1 6	7 2 0	Mat-70	F&G	G&H	ADV	ADV	4530	16	3211	9/74 2/75	6.19	6.48	1/75 5/75	7.43	42.33	.001

1/ Identify the test used and year of publication (MAT-58, CAT-70, etc.).
2/ Total number of participants in the activity.
3/ Identify the participants by specific grade level (e.g., grade 3, grade 5). Where several grades are combined, enter the last two digits of the component code.
4/ Total number of participants included in the pre and posttest calculations.
5/ Specify level of statistical significance obtained (e.g., $p \leq .05$; $p \leq .01$).

OFFICE OF EDUCATIONAL EVALUATION - DATA LOSS FORM

(attach to MIR, item #30) Function # 09-59616

In this table enter all data Loss information. Between MIR, item #30 and this form, all participants in each activity must be accounted for. The component and activity codes used in completion of item #30 should be used here so that the two tables match. See definitions below table for further instructions.

Component Code	Activity Code	(1) Group I.D.	(2) Test Used	(3) Total N	(4) Number Tested/ Analyzed	(5) Participants Not Tested/ Analyzed		(6) Reasons why students were not tested, or if tested, were not analyzed	
						N	%		Number/ Reason
6 0 9 1 5	7 2 0	Grade 9	MAT-70	7540	4117	3423	45.40%	not tested, pretest and or posttest	
								scores missing due to truancy	3,423
6 0 9 1 6	7 2 0	16	MAT-70	4530	3211	1319	29.12%	not tested, pretest and or posttest	
								scores missing due to truancy	1,319

(1) Identify the participants by specific grade level (e.g., grade 3, grade 9). Where several grades are combined, enter the last two digits of the component code.

(2) Identify the test used and year of publication (MAT-70, SDAT-74, etc.).

(3) Number of participants in the activity.

(4) Number of participants included in the pre and posttest calculations found on item#30.

(5) Number and percent of participants not tested and/or not analyzed on item#30.

(6) Specify all reasons why students were not tested and/or analyzed. For each reason specified, provide a separate number count. If any further documentation is available, please attach to this form. If further space is needed to specify and explain data loss, attach additional pages to this form.